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INTERACTIVE EXHIBITS IN MUSEUMS: DEFINITIONS, METHODS AND VISITOR EXPERIENCES

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education: Environmental Education

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by

Jolene Kay Redvale

December 1997

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Approved by:

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Dr. Darleen Stoner, First Reader — December 3, 1997 Date

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Dr. Thom Gehring, Second Reader

ABSTRACT

Museums in the 1990s have the need to address their own educational missions while providing recreational experiences for their visitors. Museum exhibition techniques are incorporating elements that recognize visitor behavior and expectations. Interactive exhibits are one method used to attract visitor attention and improve holding power and the potential for learning. Many definitions of "interactive exhibits" are recognized, but as a group are too broadly scoped. This study proposes definitions for and classification of various museum exhibit techniques, focusing on interactive exhibits and their value in exhibition methods. Museum visitors in two urban western cities were interviewed about their impressions of and expectations for interactive exhibits. Visitors could define interactive exhibits and recognized benefits of having interactives in museums. However, they did not consistently participate with interactive exhibits when they were available. Museum exhibits, especially interactive or manipulable exhibits, should match the presentation methods to the content being exhibited. Care should be taken to use interactivity techniques not only to attract visitor attention but also to complement the topic being presented.

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Introduction

The educational mission of museums in the 1990s is complex. No longer are museums displaying long rows of specimens and artifacts accompanied by pages of scientific sounding text. Nor are museums the static and secure elements of their communities they once were. An increasingly mobile population and a highly technological world allow for innumerable learning, recreation, and social choices for members of our communities. Media, including generous television choices, sports, theme parks, and computer and communications technology compete for public recreation attention and dollars. Museum personnel are increasingly aware that they need to provide programming that competes with these markets, draws and maintains visitor attention, provides an educational opportunity, while at the same time struggling to maintain enough funding to continue serving the public.

While still maintaining their educational mission, museum educators and exhibit planners understand visitors are seeking experiences that have leisure components, which include choice, self-direction, and control of one's own time; opportunities for piquing curiosity and exploring; and an environment that allows and encourages interaction with exhibit elements and with other visitors (Carlson, 1995). In short, visitors want to be entertained (Miles, 1987a).

Programs and exhibits with the ability to entertain as well as teach are found to have more drawing and holding power.

With this reality, museum personnel are looking at techniques that focus less on what visitors are actually learning, and looking more at what visitors are doing, what they expect and enjoy, and what will get them to come in or come back. What do visitors want to see? What outcome are they looking for? What benefit or value has their visit been to them? Answers to these questions will help museums and other non-formal educational institutions build the knowledge needed to help make visitor experiences positive, and ultimately, keep community support high, and keep visitors coming back. This study is an attempt to understand how interactive exhibits affect visitor experiences in museums.

Even with this combined social purpose of exhibits, the intrinsic value of a museum exhibit is to provide information and opportunities for the visitor to learn about the exhibit's topic or the substance of the institution's educational mission. The educational value of museum exhibits is potentially great, but also receives tough scrutiny from researchers and educators. While there is a general acceptance that museum exhibits can and should have educational qualities, there is not a consensus about how or

even whether they achieve that goal. Nevertheless, there are many recognized purposes and values of museum exhibits.

What Current Research Says About the Purpose and Value of Museum Exhibits

Many researchers have recognized legitimate and desirable outcomes for exhibits in addition to learning. Miles (1987b) suggested that museums provide opportunities for pleasure and to pass free time, not for actively solving problems, as problem solving is recognized as an essential element in the learning process. Laetsch, Diamond, Gottfried & Rosenfeld (1980) stated the goal of museums is to provide visitors with an opportunity to learn something and to have a good time. Learning and sharing experiences with family and friends are goals reported by Diamond (1986). Screven (1987) offered that the purpose of exhibits is not to teach, but to provide the visitor with motivation and improving attitudes toward the subject.

Elements that Can Lead to Learning

Museum personnel and many museum visitors consider learning from museum exhibits as their goal. While interest and excitement may be needed to draw visitors to an exhibit, the ultimate purpose, many agree, is that the visitor gain something from the experience. Whether this is a new interest in or perspective of the subject, or actual knowledge gained, the goal is that the visitor walk away with something, not just be entertained.

Considering learning, Diamond (1986) argued that social interaction between visitors is important to stimulate learning from exhibits. She also recognized the importance of interaction between the visitor and the exhibits to learning, but pointed out that this is not the primary condition required for learning to take place. Screven (1987) argued that a visitor must stay at an exhibit long enough for learning to take place, but that exhibits must be fun or enjoyable, or a visitor will not stay with them. On that point, Bitgood, Paterson and Benefield (1988) found that visitors will stay with exhibits that are exciting.

Langer, Blank and Chanowitz (1978) discussed the phenomenon of mindfulness, which is characterized by actively engaging in a task or activity, and processing results into one's long-term memory. Carlson (1995) recognized that mindfulness toward an exhibit is required for learning from it to take place. Moscardo and Pearce (1986) went further to say that enjoyment of the exhibit topic can lead to mindfulness. However, while their in-depth study refutes the idea that enjoyment leads to learning, they point out that mindfulness and enjoyment do enhance visitors' own perceptions of how much they learned, regardless of whether they actually learned something or not.

Interactives Can Attract Visitors, Provide Staying Power, Enjoyment, and/or Motivation, and Encourage Mindfulness

Any one or more of the outcomes of the following can be considered the goal of an exhibit, or can lead to the next progressing step of learning. Moscardo (1988) stated "interactive exhibits are successful in attracting and holding visitor attention" (p. 31). Beer (1987) discovered that manipulable objects in an exhibit are successful in getting visitors to interact, but that they do not necessarily keep the visitor's attention very long. Screven (1974b) understood that interaction between the exhibit and the visitor secures "cooperation, attention, and control" (p. 70) for the visitor. Koran, Morrison, Lehman, Koran and Gandara (1984) found that exhibits with manipulable components are preferred by visitors over static exhibits, and acknowledged that an exhibit must attract and maintain viewer attention and be informative in order to be educationally effective. Laetsch et al. (1980) also found that manipulative exhibits "attracted visitors, held their attention longer, and had a greater impact on their memories" (p. 15).

The Element of Interaction as an Exhibit Tool

Interactive exhibits have gained popularity in recent decades as the missions and the faces of museums have

changed. Today, museums are much more dynamic in their presentation of educational content than were their historical counterparts, resonating halls with case after case of old specimens, accompanied with either reams of text or little more than the name of the object and the object's donor. Museums are employing all manner of techniques to interest and draw visitors and then provide them with a stimulating and appealing experience. One very popular technique is the interactive exhibit. Providing something for the visitor to do adds a new dimension to static exhibits of the past. Encouraged to participate and affect their own experience, visitors are more involved in their own museum visit experience, and are looking for something more exciting. Boone and Britt (1994) found that visitors want more interactive opportunities when they visit museums. Because of dwindling financial support for the arts, cultural activities and museums, happy and returning visitors and an enjoyable museum experience are essential elements that lead to a balanced museum budget.

If exhibits really do let people have fun *and* learn something, then both missions -- that of the museum and that of the visitor -- can be realized. Developing and using interactive exhibits is one way to achieve this. As stated above, visitors do expect interactive or participatory exhibits of some kind when they visit museums (Boone &

Britt, 1994). Visits to many museums will reveal a wide range of interactive exhibit possibilities, including exhibits that have qualities that are not interactive but go beyond the static, visual exhibits of the traditional style. And in this exploration, one will find interactive exhibits that are well designed, successful at drawing and holding visitors, and that impart the content message.

However, there are also a fair share of interactive exhibits that do not achieve these objectives. Adding an element to an exhibit that requires some contact from visitors, such as a push-button start component, may do little toward getting the visitor to enjoy or learn. The method of exhibition and the design employed will meet the objectives best if the method matches the exhibit's message and if the method is not just a ploy to get the visitor to "do something" without making a connection to the exhibit's content or subject.

In order to get a message across to the visitor, museum personnel need to match their objectives with the visitor's needs (Williams, 1987). Therefore, research into what visitors are looking for, and their perceptions of their own visits, can help create exhibits that provide for the visitor's needs as well as holding them long enough to get a message. By asking visitors what they think about interactive exhibits, this study attempts to discern how

important interactives are to visitor perceptions of their own experiences with museum exhibits.

Classification of Museum Exhibits

Following is a section that reviews the current descriptions of various kinds of exhibits, and then proposes a shared terminology and definition of interactive exhibits. By exploring various types of experiential exhibits, we can learn more about what techniques and methods can best be used as the vehicle to impart the exhibit's subject. We need to avoid creating exhibits that have lots of bells and whistles, but do little to either draw visitors, hold visitors, or result in visitor learning.

Terminology is an important tool for understanding a topic, as well as for communicating with others about it. Miscommunication often results when people have different understandings or meanings for the same terms. Therefore, this section reviews what previous authors have presented, and proposes definitions of terms to classify various kinds of interactive museum exhibits. Such a classification will be helpful in planning exhibits; the best exhibit technique can be chosen based on the outcomes, or objectives, desired. For exhibits to be effective in having visitors learn, it is necessary to match an exhibit's objectives to the method of delivering information (Screven, 1987). Exhibits vary in how they are perceived by the visitor, and these perceptions can be critical in the transmission of information through the exhibit technique chosen (Screven, 1974a).

"Interactive" is a familiar and general term, used one way in this paper to refer to any exhibit that fits into the categories described in the literature review and in the definitions proposed below. The term "interactive" is preferred over "hands-on" for several reasons. First, "interactive" is more descriptive from the point of view of how the visitor is responding, rather than in what action the visitor takes. Interactive implies that the visitor's actions affect the experience with the exhibit, whereas "hands-on" merely suggests that the visitor is doing something with his hands. Also, "interactive" can include interaction or participation from the visitor that does not involve touching or the use of the hands, or involves more than just tactile interactions. Finally, the term "hands-on" has become common and generalized in the everyday language of the culture and in the education field as a whole, often used in ways that are imprecise and confusing. This term should not be ignored for this reason; it has at least a generalized meaning to the public, and exhibit planners should remember that visitors have certain expectations for hands-on exhibits and the museums that contain them. Hands-on activities are important in the field of education, and in recent years more and more recognized and relied upon for effective classroom teaching. Such hands-on activities in the school classroom would

appear very different from the way a visitor interacts with a "hands-on" exhibit in a museum. Because of this complex use of the term, "interactive" is used to describe a general category of exhibits, and "hands-on" will be further addressed as an exhibit method.

Review of Literature on Interactive Exhibit Types

Literature on museum exhibits has been addressing interactive exhibits for three decades. Several terms have been used to describe interactive exhibits. Throughout the literature they are mostly used interchangeably, though some authors have a specific meaning for the term they use. Almost exclusively, researchers writing about interactive exhibits are focusing on natural history and science museums and centers. This is an important distinction for two reasons. First, according to Miles (1987b), art museums continue to reflect elite culture, while nature and science museums have made a transition into the realm of popular culture. Thus, visitors to natural history and science facilities expect a more visitor-oriented experience.

Secondly, both formal and non-formal educational institutions recognize the importance of "learning by doing." Hands-on science learning activities have surged in the classroom and in museum exhibits and programs. Thus, learning takes place when the learner is actively involved

with the concepts at hand (Carlson, 1995; Laetsch et al., 1980; Moscardo, 1988; Moscardo & Pearce, 1986). Based on the contemporary learning philosophy that stresses experiential learning, then, learning in museums can be enhanced by exhibits that offer participatory experiences (Cohen, 1987). This has both encouraged museums to respond with interactive exhibits and served to lead visitors to desire more interactive opportunities (Boone & Britt, 1994).

Definitions for interactive exhibits found in the literature include: hands-on, manipulative and manipulable, interactive, participatory and active participatory. Each author's definition will be followed by a summary explanation of his or her own evaluation of the value of these exhibits. For ease of discussing museum exhibits in general, the word "interactive" is used in this section to refer to those exhibits that are other than completely static.

A manipulable exhibit is one that has something that can be handled or manipulated, though in Beer's study it refers simply to touchable objects in or adjacent to an exhibit (1987). In her study of observations of visitor behavior, Beer found that a display containing manipulable objects alone does increase visitor interaction with the objects but that the presence of manipulable objects

decreased how much of the accompanying text the visitors read.

Hands-on, manipulative exhibits, according to Koran, Morrison, Lehman, Koran, & Gandara (1984), are those that make "objects and events readily available to touch, move, observe, and listen to" (p.357-358). They suggested that as novelty and complexity of the exhibit increase, attention, number of questions, length of visit and amount of manipulation of the objects increases. They pointed out that an exhibit must be informative, and attract and maintain visitor attention to be effective. These authors showed that visitors are attracted more to manipulable objects than to static exhibits, and that this attraction is accompanied by increased curiosity and attention to the subject and objects of the exhibit.

Moscardo defined an interactive exhibit as "one that allows the visitor to make some response using the information in the exhibit" (1988, p. 31). This definition considers the kind of exhibit that allows the visitor to respond without any tactile or hands-on requirement. For example, an exhibit text may direct the visitor to look around the exhibit hall, go somewhere else, answer questions, or compare objects. An exhibit may provide other sensory stimuli, such as auditory or olfactory. Demonstrations may provide a whole-body experience, such as

when entering an exhibit booth with environmental manipulations such as color, temperature, sounds, etc. Thus, this definition of interactive is free of the touch, tactile-oriented parameter.

Moscardo (1988) connected the use of interactive opportunities to the psychological concept of mindfulness, which includes for the visitor feelings of surprise, interest, involvement and/or control, and active mental processing of information. This notion of mindfulness in nonformal learning contexts is gaining interest from some other researchers. Carlson developed a model to explain how hands-on learning takes place in museums and other nonformal education facilities (1995). Using the concept of mindfulness in learning, he realized a difference in learning outcomes from interactive devices that offered a high level of perceived control by the visitor, compared to interactives that allowed minimum levels of perceived control. An increase in perception of control was associated with increased learning. Level of control over one's own choices and experience with an interactive exhibit was also described by Koran et al. (1983).

Borun referred to hands-on devices and their relationship with good text explanations as important in helping visitors learn from their experiences. She stated that "as science museum professionals, we learn by doing"

(1989, p. 9) and illustrated in her brief article that carefully constructed and labeled devices can really teach. The example she referred to is a device, static until manipulated by the visitor, that demonstrates the concept of gravity, by causing a ball to drop to show gravity working. This, then, takes the exhibit from the simple display of objects to the provision of a device that can be worked. Exhibiting the concept depends on the operation of the device by the visitor.

Chabay (1987) gave a broad and inclusive definition to the term "hands-on" in his paper about science education and museums. Hands-on science exhibits, "...provide the user with an opportunity for concrete experience with real physical phenomena" (1987, p. 47). Because Chabay's definition of hands-on exhibits includes the complexity and scope in the variety of interactive exhibits that can be found in museums and sciences centers, it warrants repetition here:

> The most important and desirable characteristics of HOSE (hands-on science exhibits) are (that): 1) real phenomena, not simulated ones, are used in the system forming the basis of the exhibit, 2) the user can exert control over some significant parameters which affect the behavior of the system, and 3) the system is constructed in a manner that allows the user freedom for creative experimentation. As we do in our daily lives, we can explore an interactive exhibit with many senses and

> find various ways of experiencing the behavior of the system. Exhibits have been developed, which, in various combinations, use the sense of smell, touch and kinesthesia, vision, and hearing. In this paper, I refer to HOSE, but in fact, these devices are neither exhibits as in a collection of artifacts, nor are they necessarily only hands-on. As people have enjoyed pointing out, we hope the interactive and the non-interactive exhibits are all brains-on. (p. 47)

Chabay stated that one value of hands-on exhibits is that they provide the user with concrete experiences with real physical phenomena. Although Chabay's experience is mostly based in physical science concepts and does not consistently incorporate traditional museum objects and artifacts, these ideas can be easily transferred to other subject areas common to the museum experience.

Eason and Linn (1976) made the distinction between exhibits with simple push buttons that visitors use to "start" an exhibit and those that are truly participatory. "Participatory exhibits actively involve the visitor in discovering information through his own participation in the demonstration process" (1976, p. 45). They conducted observation and questionnaire research with visitors who used visitor-operated demonstration machines and open-ended exploratory activity booths, characterizing these as exhibits where the learner (visitor) is actively involved in investigating the scientific principles through direct

manipulation of the device. While Eason and Linn's experience with such visitor-operated demonstration exhibits is somewhat outdated, the principles still apply to today's sophisticated, often computer-aided participatory exhibits.

Another kind of interaction to address is that which takes place *between* visitors as a response to the exhibits viewed or experienced. Several researchers have discussed the importance of the social aspect of museum visits, from being the reason for a museum visit to being the expected outcome of the museum visit (Carlson, 1995; Laetsch et al., 1980). Diamond concluded her study of family group behavior in science museums with this idea (1986). She attributed a portion of learning in the informal setting to the social interaction between visitors. Members of family or social groups work together to experience the exhibits, and teaching occurs from these interactions. Family members often "show" or "tell" each other about the exhibit subjects. Parents often read exhibit text to their children and then encourage discourse on what was read. Children manipulate exhibits more than their parents and tell their parents about what they are experiencing. Within this model of learning, interactive exhibits can increase the interaction between visitors, thus increasing the chance that learning will take place.

Cohen (1987) gives a listing of characteristics of "interactive core," which provides a basis for interactive experiences. Some of the characteristics given are:

> *Experiential opportunities -- first-hand, direct experience of objects, processes, and ideas;
> *Multi-sensory experience -- employing other sensory modalities, particularly tactile, in addition to the visual experience;
> *Opportunities for exposure to and manipulation of variables, and receiving feed-back;
> *Appropriate degree of physical and perceptual penetration into the display;
> *Opportunities for 'realistic' as well as imaginary and fantasy role playing. (p. 16)

Another characteristic of interactive exhibits that Cohen recognized is multiple output activity (Gurian & Kamien, 1982, in Cohen, 1987). In single input/single output displays, there is only one question asked by the exhibit text, and an opportunity for only one answer to be given by the visitor. This kind of interaction is common with quiz-type exhibits. Multiple input/multiple output displays have increased variables and options for negotiating the information, and more opportunities for visitors to pace their own activity based on their own abilities, interests and experiences (Cohen, 1987).

Active participation, according to Laetsch et al., is "the ability to physically interact with objects and to

manipulate variables" (1980, p. 14). They made the argument that people visit museums to have a good time and to spend time with family and friends. This notion is enjoying more attention as researchers look beyond visitor learning as the traditional purpose of museum visits. Laetsch et al. illustrated the connection between actively participating with the exhibits and with fellow visitors as essential steps toward having a good time, which they considered the basic objective of a museum visit. In observation studies, Laetsch et al. found that manipulative exhibits attracted more visitors, held their attention longer, and had a greater impact on their memories. They illustrated the positive relationship between children's natural tendencies toward exploratory behavior, especially in novel situations, and the ability to apply exploration when given manipulative or participatory opportunities with exhibits. They also described the benefit of the free-choice learning environment and the impact it has on children's motivation and curiosity -- two cognitive elements whose presence is considered essential for learning to take place.

Another definition of active participation comes from Duensing, as "the process of allowing the visitor to change and explore some of the characteristics of the phenomena being exhibited" (1987, p. 136). These exhibits encourage investigation and participation, and may or may not

incorporate some kind of hands-on or touchable element. In other words, active participation as described here does not just refer to the touching or manual manipulation of objects. Active participation is a way to present science "as a lively process rather than a static collection of facts" (p. 131).

Koran, Longino and Shafer presented a "taxonomy of exhibits" in their study of research in museum and science center settings. They described participatory exhibits as those that "tend to stimulate interest, curiosity, and participation with the promise of enhanced cognitive outcomes..." (1983, p. 327). They proposed operational definitions of exhibit types used to enhance communication, evaluation, research and training among researchers and educators. Their approach is a continuum of exhibit types from static to dynamic. Static exhibits are characterized by containing rare or fragile specimens, labeled and presented in such a way as to focus attention, which can employ visual and/or auditory sensory channels. Dynamic exhibits are those that "require an observer to act on them in one way or another, and may use visual, tactile, auditory, and perhaps even olfactory and gustatory senses" (1983, p. 330). With dynamic exhibits, visitors are able to touch, move, or change objects.

Koran et al. filled in their taxonomic continuum with a description of "walk through exhibits, such as a cave, an Indian village... and other types of exhibits which permit the visitor to walk through and to be surrounded by changing visual and auditory stimuli, and, at times, 'interact' using a range of senses" (1983, p. 330). They stipulated, though, that walk through exhibits usually do not provide visitors with the opportunity to touch objects. The distinction between the static and walk through exhibits is that walk through exhibits surround visitors with the display of materials, including the ceiling and floor, and that the surroundings and the objects present are in context of the exhibit's topic. Static exhibits display objects out of context and sequence. For example, if a static exhibit displays a suite of stone tools, they are typically presented apart from the sequences in and for which they were made or used. They recognized that the dynamic exhibits incorporate active involvement while the static exhibits use passive reception (from the visitor's perspective). Today's exhibits are much more sophisticated and while they do fit on this continuum, there is much more complexity to be considered.

Relevance to Learning from Museum Exhibits

Studies of learning in nonformal settings resulted in the phenomena termed mindfulness and mindlessness (Langer, Black & Chanowitz 1978; Chanowitz & Langer 1980, in Moscardo & Pearce, 1986). Mindfulness -- the detailed attention to a task or activity and analytic processing of information -- and mindlessness -- where little questioning of new information is employed, and visitors are in a mentally passive state -- can be applied in the museum setting and to the valuation of interactive exhibits. Moscardo and Pearce attributed to Langer and her colleagues the notion that "passive exhibits induce mindlessness and consequently little learning, while interactive exhibits induce mindfulness and thus active processing of information" (1986, p. 93).

Williams discussed learning from museum exhibits in the context of left-brained (verbal, rational, analytical) and right-brained (patterns and holistic views) (1987). She asserted that formal schools often take the analytical approach to teaching science, and many students are left uninspired about science because they are right-brained learners. The informal learning environment -- museums -- provides the right-brained kind of learning through experiential and hands-on activities. Therefore, Williams

argued, museums can provide this opportunity, making science learning more equitable for all learners.

Definitions of Terms Utilized in this Study and Proposed for the Field

Definitions given in this review are written from the perspective that the responses of the visitor to his interaction with exhibits, rather than the actions possible for the visitor to take, are related to the outcome of the exhibit experience. That is, each definition is based on whether or not the visitor can respond to the action taken, rather than the action itself. The definitions of terms presented here are not linear; they do not necessarily represent an order of exhibits on a continuum from less to more interactive. The potential for creativity in exhibit design, to incorporate various interactive and non-interactive elements in a given exhibit, prevents a linear classification, because one exhibit may incorporate more than one type of interactive technique. These definitions describe the nature of exhibits from both the designer's and visitor's point of view. Non-interactive exhibits are defined for clarification.

Non-Interactive Exhibit Types

Inert Exhibits: Inert exhibits involve no action from the visitor beyond looking at objects and reading text. Sometimes called passive, static or display-type exhibits, these are the original and traditional form of museum exhibit. The visitor only looks at objects and reads explanatory text if it is available. In today's museum, while exhibits that provide more contact or exploration for the visitor get more attention both from visitors and exhibit planners and researchers, inert exhibits do continue to be an important technique for presenting certain objects and concepts.

Hands-on Exhibits: Hands-on exhibits provide tactile opportunities only. There is no reciprocal reaction to the action the visitor takes, and the act of touching in a hands-on exhibit does not lead to another action. There are no variables for the visitor to experiment with, and the action results in only simple imparting of information from the exhibit. In tactile sensory activity, the visitor is taking information into the brain through the tactile channel only, or in tandem with the visual channel.

Kinesthetic sensory experiences are simply one way people use their senses to take in and make sense of the outside world. Hands-on in this sense, then, is much

reduced from the popular reference to hands-on as being activity-oriented. Examples of hands-on exhibits include an animal pelt or footprint to feel, rocks with different weights that help illustrate their composition, and a sampling of various textile materials for comparison of texture.

Interactive Exhibit Types

For the remaining terms, a dictionary definition is given to provide the concept that each word represents. Because of the multiplicity of definitions given by the references in the literature review, this grounding is important so a common definition as applied to museum exhibits can be proposed and supported. For those words with multiple dictionary definitions, the definition given here is the one that is best applied to exhibit methods and objectives.

Interaction = mutual or reciprocal action or influence

Interactive = mutually or reciprocally active

Manipulate = to treat or operate with hands or by mechanical means especially in a skillful manner

Manipulable = capable of being manipulated

Participate = to have a part or share in something

Participation = the state of being related to a larger whole

(Merriam-Webster's, 1983).

Manipulative and Manipulable: Manipulative exhibits are those that offer an opportunity for objects to be touched, moved and handled, or provide an opportunity for a mechanical or electronic process to be initiated. This includes hands-on exhibits. The visitor takes an action but does not have an opportunity to further respond to that action. Sophistication in the action or response is not required for an exhibit to be manipulable. An exhibit that has a push button or lever start component that is required for the exhibit to "start" is manipulable. Some very sophisticated manipulables are present on museum exhibits today. Wheels, levers, doors, cranks, lights and more techniques are employed in providing a manipulable component. Handling or operating the manipulable component(s) is required for the visitor to gain access to information in the exhibit.

Even though manipulable basically refers to use of the hands, included are exhibits where text is presented auditorily, since contemporary museums often use audio as a

means of providing accessibility and variation to the presentation. Auditory text or sounds may be made available with or without a listening device. "Manipulable" refers to such objects or mechanical/electronic exhibits, or the device used in the manipulation. For those exhibits employing sound, if a device is required to hear the sound presentation, such as headphones or a tape player, then such a device is the manipulable component.

Interactive: An interactive exhibit is one that gives the visitor an opportunity to act, *and* provides a variable response to that action. It provides visitors with an opportunity to *interact*, not just *to act*. This concept of reciprocal action is the essence of the definition for interactive proposed here. An interactive exhibit is one that allows the visitor to respond to action taken.

Active Participation and Participatory: For active participation, borrowed is Duensing's definition that states, "... the process of allowing the visitor to change and explore some of the characteristics of the phenomena being exhibited" (p. 136). Eason and Linn define participatory exhibits as those that "actively involve the visitor in discovering information through his own participation in the demonstration process" (p. 45). Thus,

the exhibit provides objects, activities or actions that give visitors the opportunity to explore the topic in their own way. This kind of exhibit is highly variable, and depends on the visitor's participation to present the topic fully or in the most complete way. In comparison to interactive exhibits, participatory exhibits provide the visitor with an opportunity to have an increased sense of control over the exhibit variables. Participatory exhibits are a subset of interactive exhibits.

Classification of Exhibits for this Study

The classification of exhibits presented here is based on the visitor's point of view, including no action or response, the action the visitor takes (i.e., visitor pushes a button), and possible response to that action. If an exhibit consists only of prose text to read and objects to look at or has start buttons to push, the exhibit is not interactive. If the exhibit involves or encourages response to an action, or it provides for a visitor-oriented exploration or discovery process, it is interactive. Again, "interactive" here is used to describe a variety of exhibits that are not static in their presentation method.

In this section, types of exhibits will be grouped into classes based on whether the visitor takes some action and on the kind and depth of response in which the visitor

is involved. In a linear representation, exhibits involve either no action, action without interaction, or interaction. However, exhibit planners should not look at these as the only types of exhibits that can be prepared. Certainly creative exhibit design can incorporate more than one classification type.

Non-Interactive Exhibit Types

Static Visual: These are exhibits that do not move and that have no moving parts, such as push buttons. Static visual exhibits are the familiar, old style exhibits that were first used in museums and are still used -- both effectively and ineffectively -- in museums today. These exhibits may have information presented with written text, photos or other pictures, and usually focus on the presentation of objects from the museum's collections. Static visual exhibits may be two- or three-dimensional. Examples of three-dimensional exhibits include artistic sculpture, a replicated tree and its microhabitat, or the reconstruction of room in a historical house.

Visual Motion or Dynamic: It is important to describe exhibits in motion since exhibits that "move" are sometimes grouped into the category of interactive. Of course, static exhibits, with positioned objects and stationary prose-style

text, are not interactive. Additionally, exhibits that move or have moving parts are not interactive, even though there is motion involved. Working models of natural and physical phenomenon and demonstrations can be dynamic exhibits. Such exhibits may attract interest because of the potential and possibly infinite changes available. However, if there is no opportunity for the visitor to take an action or to affect any response or change, then the exhibit is not interactive.

Live animal exhibits are very popular, not just in zoos, but increasingly in nature centers and museums. Exhibits of live animals are dynamic in that the animal is moving around in its enclosure, but as such are not interactive. If an animal is available to be petted, for instance when a keeper or educator is on hand, then interaction with the animal and the interpreter is obviously possible. In this case, however, the animal, only an element of the whole exhibit, is removed from the exhibit itself, and the exhibit per se is not interactive.

Animal exhibits often engage visitors deeply and for greater lengths of time than other types of exhibits. Interaction among visitors, especially family and group members, often increases with live animal exhibits. Visitors may even exact a response to their own behavior from the exhibited animal. One may argue that this makes

the exhibit interactive, but if such interaction is not a planned outcome of the exhibit, then the exhibit is not truly interactive and the animal's response is a special treat for the visitors.

Static Audio-Visual or Multi-Media: These exhibits are presented in video or movie form. Many museums have tiny theaters with a few benches, where one small portion of the overall exhibit is presented in audio-visual form. These presentations usually supplement other exhibit components, but may be used as the only style of presentation used for a particular "exhibit." (The use of movies and videos challenges the definition of an exhibit, but since they are used as exhibits by some museums, they are considered here.)

Audio Device: Some exhibits have sound constantly wafting into the gallery space, while others play recordings only when a visitor is present or uses a listening device. Static audio presentation of exhibit content is usually delivered either constantly or when a visitor passes by a motion sensor that automatically starts sound playback. Some exhibits offer a listening device through which sound is transmitted, such as headphones, "telephone" receivers, sound wands and many other types of instruments now available. With these the visitor must take an action, such

as putting on headphones, to make the sound available. This action delivers the sound, but involves no response or interaction with the exhibit. Audio devices have the additional advantage of making exhibit text available to visually impaired visitors.

Visual Device: Visual devices are very popular in museums and can take many forms. Buttons, levers, wheels, doors, flaps, joy sticks, etc. that are used to start the exhibit or provide access to the exhibit content are visual devices. For example, a static exhibit can come to life with motion when the visitor pushes a button. By pushing a button, lighting can be accessed to illuminate an otherwise dark exhibit case or text panel. A flap may be lifted to access related or follow-up information or the answer to a question on the outside of the flap. Exhibits with visual devices may be complex or fancy in their presentation, taking various forms and having various results. The point to remember for this category is that the visitor must take some simple action, sustained or unsustained, to access the exhibit content, without any real opportunity to make a response to the action.

Visual devices are basically used as an attractor to get the visitor's attention before presentation of the exhibit content. It can be used effectively to draw and

involve the visitor in the experience (Screven, 1987), or to help in selection of exhibit content choices. Even though commonly considered interactive, these exhibits are not, because the visitor is not given the opportunity to respond interactively or change any variables. The visitor simply takes some action to gain access to exhibit content. A great bulk of so-called interactive exhibits found in museums belong in this non-interactive, visitor-takes-action group. They are common and popular among visitors and exhibit planners alike.

Tangible Object: These exhibits provide some element that visitors can touch, but does not provide any feedback to the visitor's action. The action is limited to touching the object, which provides sensory input through the tactile channel. This is a very effective and beneficial technique used by exhibit designers, especially for use with special needs visitors who respond well to tactile stimulation. Nevertheless, because there is no opportunity for further interaction with the exhibit component, these exhibits are not interactive.

Although this category description does not match the popular concept of "hands-on," this paper proposes that this description is the best for the term in museum exhibit planning and design. To be hands-on in the kinesthetic

sense is to use the sense of touch or feel to gain information about the outside world. Therefore, putting one's hands on an object fits this category. While this is a technicality in the use of the term hands-on, the term is not likely to experience a vast change in usage, especially in the popular cultural realm, and is used here to further clarify the exhibit types for the purposes of classification.

Walk Through: Described by Koran et al. (1983), walk through exhibits present objects in a total-environment context. The exhibit consists of a simulated environment with multi-sensory stimuli present. Objects are placed in their context, usually artificial or replicated, rather than removed to a static display. Walk through exhibits simulate a transformation in time and place, bringing the visitor into the realm from which the objects come. Exhibits of this type can be used to convey the importance of the whole story of the objects, including, for example, a people's culture; a fossil or artifact excavation; or an important historical event. Such an exhibit may or may not have things that visitors can touch. The exhibit is more experiential than tactile. A contemporary walk-through exhibit may be called an "immersion exhibit," providing a deeply involving experience that appeals to many sensory

channels and gives the visitor the feeling that he is in the time and place that the exhibit topic exists (Bitgood, 1994). Living history exhibits that incorporate costumed interpreters in the telling of the exhibit's content, are immersion exhibits. (However, if the living history presentation includes conversation between the costumed characters and visitors, then it becomes interactive; see Experiential category below.)

Interactive Exhibit Types

Tactile with Comparison: As stated above, a tangible object such as a piece of an animal's fur, a replica of an artifact, a swatch of fabric, or the silhouette of a large bird's wing span outside an exhibit case can bring an additional sensory experience to an otherwise statically visual and cased object or specimen. Such opportunities often draw the visitor to the exhibit, as well as provide the additional sensory dimension. Simply touching an object is not interactive, because there is little opportunity for the visitor to change any variables or respond to that action.

However, if an invitation is made for visitors to compare, either two objects, an object with the visitors themselves, or an object with an idea or experience, then visitors can relate the object or concept to their own

experience, and the exhibit becomes interactive. Such an invitation may be made through written text, the availability of several objects to touch, or via an interpreter. The visitor is affecting the outcome by deciding on the extent of the comparison and applying personal background to the experience. Relating an object to the visitor is an effective technique used to encourage actual learning in many educational settings, as well as to make a museum visit experience more personal.

Directions or Invitation to Explore: In these exhibits, the text invites the visitor to answer questions, think more about the subject, or look elsewhere in the museum for related objects or ideas. The extent to which the visitor does answer or explore affects the results of the experience. The visitor applies the knowledge he already has to the invitation. Not relying on physical manipulation of the exhibit itself, the visitor can make passive connections with additional elements or the exhibit concepts through the written text. Thus, the visitor is responding to the text or exhibit elements, and this response is here considered interactive.

This technique can be very useful to help visitors draw relationships between various objects and concepts on their own, thus reducing the need for lengthy text and giving

visitors more control over their own experience. This feeling of control over one's experience is valuable in the learning process (Carlson, 1995; Laetsch et al., 1980; Moscardo & Pearce, 1986). A common technique to encourage this kind of exploration is plastic laminated cards that visitors can read in place or carry around the exhibit space, looking for objects referenced on the cards.

Quizzing: One way of making button pushing (door lifting, lever rotating, etc.) more meaningful -- and interactive -- is to attach some kind of response to the action. For example, an exhibit panel may present questions with possible answers, and respond with a "right" or "wrong" sound when the button is pushed. The visitor reads the question, chooses one of the possible answers and pushes the corresponding button, and gets feedback from the exhibit. This exhibit style employs the teaching technique of quizzing and feedback, at best a questionable method for efficacy in teaching. The style does, however, add interest to an otherwise dry textual presentation of the questions and answers, and adds interest and holding power to the exhibit.

Various levels of complexity can be added to the quizzing technique, but the response provided by the exhibit is the identifying factor for this category. For example, a

quizzing exhibit may provide the visitor with open-ended answer choices, or ask the visitor to choose several answers that may be applicable to the question. The quiz may be set up so several answer choices are offered, and the quiz does not give a right or wrong feedback, but lets the visitor develop his own conclusions. The added variability in this type of quizzing exhibit contributes to the potential for mindfulness in experiencing the exhibit.

Experiential: Popular in science centers, experiential exhibits have adopted the educational philosophy that if people "do" or experience a phenomenon, they are more likely to understand it and therefore "learn" it. Thus, when a visitor dons a pair of foam "wings" and steps into an enclosure with a wind machine, she will experience the physical phenomenon of lift first-hand. Experiential exhibits most often present a phenomenon or law of nature, rather than presenting objects or artifacts. They frequently involve highly physical actions, such as stepping in front of a wind machine or sitting on a spinning platform to experience centrifugal force. The depth of interaction in this type of exhibit depends on the degree to which visitors can control the variables of the exhibit, and control their own experience.

There is great variety possible in the presentation style of experiential exhibits, as well as innumerable concepts that are well exhibited using this method. It is an especially good method to use for exhibits that describe aspects of physical science. Also included in this category are interactions between living history characters and visitors. In living history exhibits, museums are adding a dimension of direct experience through costumed interpreters. Visitors sometimes have the opportunity to interact with the characters themselves.

Creative Exploration or Role Playing: Role play in a thematic context, such as a museum exhibit or play area, is a powerful way that visitors, especially children, can absorb knowledge (Cohen, 1987). The visitor assumes the role of an exhibit element and uses play, free association, drama and other expressions to determine her own inputs, goals and outcomes for the exhibit. Examples include puppets, costume trunks, toddler play areas, simulated fossil digging, playing with objects in a sand box, and building and testing structures with provided materials. Again, the level of interaction with these exhibits depends on the ability of the visitor to control the variables and his own experience.

Participatory: These exhibits provide the maximum amount of participation with the exhibit's content as possible, to the point where visitor participation is required to make the concepts of the exhibit realized. The visitor-driven action is a required component of the exhibit itself, and the content of the exhibit is not completely displayed or demonstrated until the visitor participates. Examples of participatory exhibits include building structures to demonstrate concepts of construction and physics, using actual medical equipment to perform simple tests to demonstrate use of instruments or concepts in medical science, and working with archaeology tools to uncover artifacts buried in sand to experience the precision and patience required for archaeological and paleontological excavation activities. Made popular by science and technology centers, participatory exhibits have evolved and become very widespread since their first use in exploratory-type museums.

Computer Tour and Computer Simulation: A computer program with visitor-accessible touch screen capabilities may be a visual motion exhibit. If the visitor moves around within the program, accessing information in a self-chosen pattern, but has no opportunity to affect any outcome of a problem posed, then the exhibit is visual motion and not

interactive. Even complex programs that offer volumes of information are no more than visual (and perhaps audio) presentations of information. This kind of computer program may incorporate a quiz, provide additional information about the museum's collection as a whole or about objects on display, and add an experiential-like dimension to the static exhibits around it. That is, the computer program may provide pictures or video clips of an archaeological site from which nearby artifacts were excavated. Still, if the computer is only providing information, then it is not interactive.

However, simulation programs are interactive. In these programs, there is usually a problem posed that gives the visitor the opportunity to make choices in order to solve it. For instance, a program might pose the problem of determining the cultural use of an excavated artifact. The visitor would use options provided by the program to devise a method for determining the object's use. The scope of this kind of computer program is only limited by the creativity of the people who design it. Much research is being done to determine the effectiveness of computer programs as museum exhibits (Borun, 1983; Flagg, 1994; Hilte, Hennings & Springuel 1988). Museums traditionally base exhibits on objects, but modern science centers often have few or no objects presented in their exhibits. Instead

they "display" concepts of physical science. Because the computer presentation is a relatively new exhibit method, the field will take some time to sort out just when and how computer terminal stations are best used for exhibit purposes.

Summary of Definition and Classification Section

Eason and Linn (1976) defined exhibit effectiveness as a measurable transmission of information about scientific principles from the exhibits to the visitors. It is hoped that the classification of exhibits presented here can be helpful when educators and exhibit designers are choosing the medium or vehicle to present their topics. Care should be taken to consider which kind of exhibit can provide the best opportunity for the visitor to successfully achieve the desired objective. Various subjects and topics familiar to museums will fare better if they are presented in a medium that makes visiting with them conducive. Exhibit planners and designers should first have a clear idea of what they want the visitor to come away with, and then design exhibits to best match that goal (Chabay, 1987; Cohen, 1987; Flagg, 1994; Williams, 1987).

Further studies into how visitors behave in museums and what their expectations and goals are will provide insight into producing effective exhibits. If visitors really are

expecting to encounter interactive exhibits when they visit museums, then exhibit planners and educators can respond to visitors' needs by preparing the kinds of exhibits that best suit the topics, and making them as visitor-friendly as possible.

One last point for museum professionals to consider is the integrity of promoting "interactive exhibits" in their museums if they in fact only have visual motion exhibits and a few push buttons. Using the term and idea of interactivity is easy to do, and tempting when planning promotional materials and events. However, true interaction between a visitor and an exhibit can have a significantly different outcome than the provision of a simple push-button manipulable exhibit. Since exhibits should be planned and evaluated based on desired or anticipated outcomes, the use of interaction should be included when it can help achieve the appropriate outcome. Therefore, the promotion of interaction in exhibits should only be used when the exhibits are truly interactive.

Research Method and Data Analysis

To understand visitors' perceptions of their own experiences with interactive exhibits, this study used visitor interviews to explore motivations and impressions visitors have for and about interactive exhibits. Most studies reviewed for this research used observational techniques to learn about visitor behavior. Interviews with small groups of visitors were conducted to seek an understanding of what the visitors themselves thought about their experiences with interactive exhibits.

This study has explored visitor perceptions of their own museum experience, as a foundation to understanding what makes a positive visitor experience, with a focus on learning the role of interactive exhibits in that result. Using naturalistic inquiry, open-ended interview questions were constructed to seek those elements of visitor experiences that visitors themselves considered positive and having contributed to an enjoyable experience. Visitors were asked what their perceptions of interactive exhibits were, what elements of the exhibits they liked best, and if they thought they learned something from their visit. With the understanding that interactive exhibits can heighten the likelihood of a positive experience and even of learning, interview subjects were asked to focus on their perceptions of interactive exhibits. This study, then, has looked for

the relationships between interactive exhibits and positive outcomes in visitor experiences.

Two sets of data were collected for this study. The first focused on adult and child responses to questions about their experiences in an exhibition that incorporated interactive components. The adults and children were asked questions that related to their participation with interactive exhibits and with each other. The second set focused on school children who visited a series of exhibits with their classes, and emphasized their knowledge of and expectations about interactive exhibits. Both sets of interviews included inquiries into the subjects' ideas of the benefits of interactive exhibits, and whether or not they recognized the exhibits they visited as interactive.

Method

Naturalistic inquiry is gaining acceptance as a valid method for studying visitor perceptions, complementing the self-direction of visitors in interactive settings (Koran, et al., 1983; Laetsch, et al., 1980), and allowing for research questions to focus and results to emerge as information is gained (Beer, 1987). For the first part of the study, visitor interviews were conducted by an experienced educator at the San Bernardino County Museum in Redlands, California. The educator participated in the

design and development of the exhibits that the interview subjects experienced. The same educator facilitated focus groups of fourth through sixth grade students at the World Forestry Center in Portland, Oregon, there interviewing students who were selected by their teachers to participate, from classes that were invited to attend the museum for the purpose of providing interview subjects for this study. This participant-observer approach lent a depth to the interview questions that allowed the interviewer to use a broad question format to seek comprehensive responses related to concept attainment and understanding, self-reporting of outcomes, and a more personal locus of control on the part of the visitor. Subjects were given control over the depth and breadth of their responses, and were encouraged to add to the interview any feelings or perspectives they experienced. (See the Appendix for research questions.)

Data Set One -- The Study Setting

Subjects were chosen from visitors to a temporary summer exhibition about southern California herpetofauna. Within the exhibition were several manipulable and interactive exhibits that demonstrated characteristics of reptiles and amphibians, gave illustrations and scenarios about herpetology and conservation ethics, and provided

opportunities to watch live animals in action and to role-play what visitors already knew or had learned about the exhibit content in general. Twenty-eight wall panels held text cards and photos relating general information about snakes of the world, and about southern California herpetofauna, habitats, and conservation. Each interactive station had a brief description of the phenomenon being illustrated and instructions on what to do. A painted hardboard tortoise graphic identified each station, and gave uniformity to the text blocks accompanying the interactives.

Purposeful Sampling

Subjects were purposely chosen who appeared to be likely to share their impressions thoroughly, clearly and articulately. Further, subjects were chosen based on three ideals:

1) Subject sets consisted of adult-child diads or triads, with the child/children ranging in age from seven to 13 years; the adult was not required to be the child's parent.

2) The interviewer approached visitors who seemed to have moved slowly and with intent through the exhibition hall, and who apparently had looked at most of the individual exhibits in the hall.

3) The interviewer approached potential subjects who neared the exit casually, thereby avoiding those visitors in a

hurry to leave, and seeking visitors who seemed likely to have time to spend participating in an interview. Six sets of visitors were interviewed and their responses were recorded for this study.

Data Collection

Once subjects were approached and agreed to participate, they were brought to a quiet room where the interview took place. Interviews were recorded on cassette tape, and the interviewer took notes on an interview schedule about observations made during the interview. Warm-up questions such as "Have you been to the museum before?" and "Why did you come to the museum today?" were asked to put the subjects at ease. The purpose of the study was explained and consent to participate forms were signed by each participating adult. The interviewer used the interview schedule as a guide, but, though all questions were asked, deviated from it in order to allow for a more natural flow of conversation with the subjects. Appropriate questions were added as topics were explored and as a way of encouraging subjects to give thorough and well developed responses. Data was derived from cassette tapes and transcribed. Responses were coded to subject, and matched with responses from other subjects for each question. For responses to questions that were not on the interview

schedule, natural patterns emerged and responses were grouped.

Presentation of Findings

The interview schedule included some questions intended to illicit specific responses from the visitors, and questions designed to encourage open conversation and input from visitors. Because adults and children were asked the same questions, and often worked together in an interview to give responses (such as the adult prompting child, or one adding to the response of the other), responses from children and adults are not reported separately here. With few exceptions, responses are paraphrased to clarify spoken language and to summarize responses. Responses from individual subjects are separated by a semi-colon; explanatory notes are given in parentheses.

The Responses

To set the stage for the first questions, the interview stated: We are looking for people's ideas about interactive exhibits.

Question 1: Tell me what you think an interactive exhibit is.

Responses:

holding animals; touch and explore things, manipulate the exhibit and

thereby learn from it; talk to people who can explain what the exhibit is about; fun; petting animals; an activity; learn more when exhibit employee explains things.

Outcome: All subjects had an idea that interactive exhibits provide something to do besides just look at the exhibit content. Also, while their own definitions of interactive exhibits did not include live animals in a closed glass cage, the live animals in the exhibit were often described or included in elaborations on the interactive exhibits.

Question 2: What is the purpose of an interactive exhibit?

Responses:

greater involvement, perhaps greater understanding of the exhibit subject; more fun; learn more about it, take an interest; learning, because people learn by doing; to better educate and learn about the exhibit itself; get more education; being able to touch things; to get more people here (to come for a visit).

Outcome: Responses show that subjects have a basic understanding about the commonly accepted purpose of interactive exhibits: learning.

Question 3: Did you recognize the interactive exhibits in the exhibit hall?

Responses: Four of the participant sets responded positively that they did recognize the interactive exhibits;

one set said no, they did not recognize them. Some positive responses included descriptions of the subject or phenomenon presented in the exhibit. However, while some responses were positive, further exploration revealed that subjects seemed unclear about which exhibits contained interactives. They talked about or elaborated on noninteractive exhibits, and on topics that were presented in text panels instead of through an interactive exhibit, suggesting that they did not know or were unable to distinguish what is meant by interactive.

Outcome: The fact that subjects did not consistently recognize which exhibits contained interactive elements suggests that the knowledge of the presence of interactions is important to visitors, but that their actual presence is not as important and therefore possibly is not expected or truly regarded as essential to the visitor's experience.

Question 4: Did you participate in the interactive together? How?

Responses: One participant set said they did not even do the interactives, while the other five sets said yes, they did participate in the interactives. In two cases, the adult read the text while the child or children manipulated the exhibit components. In another set, the child showed the adult what to do with the exhibit. In one set, the

adult read the text and asked the child questions about the topic.

Outcome: While participants generally participated in the interactives, they did not visit them all. But when they did visit an exhibit, they worked together, sometimes adult demonstrating or explaining, and sometimes the child or children leading the adult.

Question 5: How did experiencing the interactive exhibits together affect your overall experience today?

Responses:

easier to remember; more fun and enriching; enjoyment; child motivated adult to participate; interaction more education; helped younger child to do them; being with parent helped child focus and read and not just play; more fun to do with somebody; adult helped child to understand; doing together makes it more interesting.

Outcome: All participants gave positive responses about working together and participating, including the interviewees who said they did not even do the interactive stations.

Remaining questions were asked to get general responses and a clearer idea of what visitors gained from their experience with the interactives. While their actual learning was not being evaluated, the interviewer attempted

to determine to what extent interactive exhibits impacted visitor perceptions compared to the noninteractive exhibits.

Some questions asked for visitor preference among exhibit types: did they prefer the interactives or the static text and photo panels? While participants gave clear ideas of what interactive exhibits are, and what they are for, they did not always keep clear which things in the exhibits were interactive. For questions about preference among interactives and noninteractives (text and photo panels), responses often combined details from specific examples of both kinds of exhibits. When asked to relate some detail they remember about specific exhibit content or subject matter, all participants were able to describe content of individual exhibits or of sets of exhibit pieces. For instance, "the panels were all about snakes" was an accurate response. Other times, visitors remembered specific exhibits but did not know their exact topics. In many cases they referred to a given topic, and carried the same information through while looking at other exhibits. For example, a topic appeared on a text panel and again in the video, or an animal was shown on a text panel and the visitor went to find the live animal in its cage.

A final question asked participants about their own perception of their learning. All sets gave specific examples of something they learned. All responses could be

connected directly to subject elements present in the exhibit, but, of course, this does not constitute evidence of real learning.

Question 6: What would you say you learned from your visit today?

Responses:

> I learned a lizard can walk on water; I learned when animals have camouflage that also helps them get their food; one guy was feeding worms to the turtles; some particular traits, like I wouldn't have thought frogs would live in the desert; garter snakes give live birth; I thought it was interesting that snakes have so many vertebrae, and that each one has a set or ribs; I learned more here because at school there are encyclopedias and they don't tell a lot about it; but when you come here there is the stuff to read, and it is interesting.

Outcome: While we cannot be sure these details were actually learned on the day of the visit and were not previous knowledge just being recognized, all subjects could give a specific example of what they learned. In the case of the last response, perhaps reptile facts were not as important as learning that the exhibit, and museums, are good places to come for information and to learn, compared to other familiar learning/information sources.

Data Set Two -- The Study Setting

The World Forestry Center is a private museum that focuses on the natural and economic aspects of the American northwest forests, forestry management and forest issues. Two floors of exhibits present a variety of topics, including a historic regional fire, petrified wood, old growth forests and their resources, and rainforests and their resources. Sprinkled throughout the exhibits are a variety of opportunities for visitors to take some action with the exhibits, including visual devices, tangible objects, audio devices, computer simulation games, and audio-visual presentations.

Purposeful Sampling

Sixty students from six upper elementary school classes were interviewed in ten small groups of four to eight. All students were invited to participate in the interview, but a few students gave little or no response to any of the questions. Students were seated in a small theater and their responses to questions were tape recorded. In the presentation of their response data, all student responses were grouped by question. Occasionally the researcher and students carried on a short discussion about a response, and these discussions are given in the text after the general responses from the group.

Data Collection

Interviews were recorded on cassette tape, and the interviewer took notes on an interview schedule about observations made during the interview. The interview schedule used for this second set of subjects is included in the Appendix. The interviewer used the interview schedule as a guide but, though all questions were asked, deviated from it in order to allow for a more natural flow of conversation with the subjects. Again, appropriate questions were added as topics were explored and as a way of encouraging subjects to give thorough and well developed responses. Data was derived from cassette tapes and transcribed. Responses were coded to subject, and matched with responses from other subjects for each question.

Students were asked questions, and given an opportunity to discuss their responses as much as they desired. The first question, Do you know why your teacher planned this field trip for you today?, was used to put the students at ease as well as to establish a baseline for their motivation in viewing the exhibits. By asking, Did the exhibits help you with your understanding of the topics?, the stage was set for talking with students about their impressions of how interactive exhibits may or may not change the outcome of their experiences with exhibits in general.

Presentation of Findings

Following are the responses given by the interview subjects. Some generalizing of responses has been done, especially when summarizing multiple similar answers to the same questions. With few exceptions, responses are paraphrased to clarify spoken language and to summarize responses. (Most of the responses are given, separated by semi-colons, and duplicate answers, from more than one student, are indicated with a number in parentheses (for example, (3)):

The Responses

Question Set 1: Do you know why your teacher planned this field trip for you today? Did the exhibits help you understand the topics?

Responses:

> Because we are studying Oregon history in class; so we can learn about stuff like trees and how old they are and other things about the forest; so we don't have to stay in school and get in trouble; she (the teacher) planned it for us so that we could do some things she wrote down on this paper, the World Forestry Center Scavenger Hunt, and we're supposed to look for things, and some of it is stuff we already know, and some of it is stuff that we didn't know, and so we tried to learn about it and see what new things we could learn from the stuff that we already knew; we're here so we can learn more about the environment because we go down to Johnson Creek and we help out the

environment, so we're here to learn about the different plants; to learn about forests; one reason we came here is because our buddies wanted to come (referring to younger class they are paired with); (one student comments that the movies are boring, and other students express agreement); they help you because if you don't know about forests and you want to study them, like tropical rainforests and stuff, those little things outside that you flip up and pull up teach you about forests; its the same as the stuff we learn in school; to learn about trees, and how we can save them and how they are made (5); because she wants us to learn about the trees and the forest and how everything grows in it (2); we're studying about trees and Indians and things so we went here to see what it was like (3); just here for a field trip (3); we're studying a little bit about plants (2); well she brought us here so we can learn more about the forests and things that have happened in the forests like forest fires and the Wilderness Act of 1964, stuff like that so that we have knowledge about it; well its so we can get more educated about forest fires so we know how to prevent them from happening, and we know the good things that have happened in case we want to get a job; I think (this trip) is for general knowledge; we started making a probe, which is like a certain topic we look at and give information about it (2); to learn about trees and stuff; she wanted us to learn and like pay attention so we know a lot about nature and stuff; and we're learning about forest plants and animals too; were learning about how we could help rain forests, and different kinds of forest and old growth trees and stuff.

Outcome: Most student responses indicated they had some preparation in the classroom for their field trip. Students were able to relate museum exhibit topics to classroom topics they had studied or were going to study. At the time of the interviews, students had been to see most of the museum exhibits, and much of what they had seen was reflected in their responses. Some responses included study topics that are not reflected in the museum's exhibits.

Responses indicate the students understand that they can come to the museum to learn about the museum's topics, and apply this knowledge to what they are learning in school. Since the classes were invited to come to participate in this study, the actual objectives of the teachers were somewhat generic, according the student responses.

Did the exhibits here help you to learn about the topics you are learning about in school?

Responses:

> Yes (14); some of them did, some of them were really boring; sometimes they're fascinating, because they have interesting things that we don't know; like a Douglas fir, we went and we looked at the cookies for the rings, over 500 years old; Douglas fir is good because it's the state tree, so we get to learn about that (3); it helps with research on forests; it can tell you about some animals that live in trees and stuff; not too much; it helped me a

lot to understand it, especially, I know that I learned a lot because I was always jumping around and going one place and then another; I liked that big stump because its amazing to me how fat trees can get; we're not done yet, but so far yes; except for the talking tree because you couldn't hear it.

Outcome: Students generally felt that the exhibits helped their understanding of the subjects presented. Narrative responses indicate these students could relate the exhibit topics to their own experiences in the classroom.

Question 2: What was your favorite part of the exhibits?

Responses:

The hands-on stuff; the talking tree (6); all the hands-on things, except little computer simulators, they took too long (3); it was like the life cycle of trees and how old trees were; (in response to last answer) and how trees have names; how old trees were, like they had a forty year old Douglas fir tree, a fifty-year old trunk; yes, and it showed the little rings (2); the different kinds of trees; and then we made little tree trunk type things with little rings (this is an activity within the exhibition that consisted of wooden rings of different sizes that are placed within each other); it said if you got a really big one, you got a fifty year old tree, so you put that on and filled it in; the burn exhibit (6); I liked the part where they had the little puppets, the tree was cool, too; I liked where you could put the headphones on and listen to the different animals; one of them was about how people use wood in different ways like the Indians, the Americans, and their different stages of life; there was a rainforest exhibit

where they show different types of trees and how long they can live; the other one was about wild animals and information about them; when you gotta put your hand in the dirt; it shows you something about cheetahs, my favorite animal; I like the part when you got to play with the animals, because no parents were around and you could fight with them (referring doing role playing with the animal puppets); I like the bear; I like the sculptures and stuff that they had, all of them; the squirrel living in the tree; I liked the raccoon; I liked the Tillamook burn, that was a nice exhibit. I also liked to see that little landscape where they showed where it burned, and I also liked those little telephones (these phones played recorded information about the burn exhibit); I liked the talking tree and those phones and that little video thing, and where the fire came down (in this exhibit lights glow to indicate burn locations on a large horizontal relief map); the big trees outside, and the train, and I liked where they put the coals outside; I liked that big stump and the talking tree, because it can get in different languages and we had to push buttons; I think probably all about the Indians; I couldn't decide because I love lots of stuff -- I love trees and I'm just interested in things and I can't decide; the part with all the Indian stuff, it showed what it looked like 200 years ago; I liked the part where it showed the trees, what kinds of trees and the insides of them; I liked the huge trees, and how long they live, they live longer than I thought; I liked all of it, it made me learn stuff; this interview part; fire and old growth; my favorite part of the exhibit was where there are these stuffed animals; going into the rain forest exhibit, and you got to lift up these cards and it said something

about it; I liked the rainforest also, it had a lot of interesting facts and good trees; mine was the rain forest also, because I've always had an interest in the rain forest, it was kind of interesting to like look at some of the things like the snake; the computer games; I liked the movies and interesting things like animals in those glass things that you read about, its just fun reading about things and learning about new things; I liked it when they gave a whole lot of information; I liked the last part about the tropical rain forest and stuff, and the butterflies and how their wings are clear, and I learned a lot about what's inside the trees and what they are used for; my favorite part is the rain forest and those walls where you pull the things up and it shows what lives in the water; I liked the tropical rain forest like everyone else did, but what I think they can improve on is to make some more speakers and other type things (such as) computers and models of different kinds of tropical animals and tropical people; that girl lying down watching TV upstairs, when I walked in there was Indiana Jones on it (one exhibit shows a living room filled with objects made of rain forest woods, and a mannequin girl "watching" a video on a television set); I like the forest of stone exhibit (an exhibit on petrified wood).

Outcome: This question was asked to get a sense of how much of the museum the students had seen. It is useful to note the diversity of responses given, as well as references to many exhibits in the museum that include visitor participation and exhibits that are manipulable or interactive. Students often responded to each other's

answers, elaborating on an exhibit mentioned, or suggesting changes or improvements to particular exhibits.

Question 3: I'm especially interested in interactive exhibits. What are interactive exhibits?

Responses:

Computers (3); any electronic stuff (5); there's listening places, where you listen to jungle sounds; where they ask a question and there's a picture and you have to find different things, and you lifted it up and there was the answer there; where you sit down and look at all the pictures (3 -- referring to the motion picture viewing area that provides bench seating); listening; the puppets (4); where we made this tree thing with Velcro parts you stuck on (2); when you listen to the talking tree; its like an exhibit where you can touch things, and it's not like an exhibit where there are just pictures, you actually feel what it's like if you were there; the big huge tree that you can touch (3); also is it like a show?; like you're actually interacting, you're involved in what you're doing; its where you get to touch; listen; feel; interact (2); see it physically, touch it physically; you get to see something, not just the words but see the real thing; lights, sound; theaters and stuff; TV (probably referring to the wood products exhibit that shows a girl watching a television set); probably most trees; models, shaped like the real things but not really; the tree stumps (there are eight tree stumps attached to the wall in a manner that allows them to be touched and the growth rings counted); the first thing that I saw was the bear with the fish in its mouth

(this is a wood sculpture in a location accessible to being touched); the soil in that thing (referring to a box that holds a nursery log and ground litter that can visitors can put their hands into) (2); I like those little things that you pull up and they ask you questions (flip-up doors with a question outside and an answer inside); the models, like you can actually touch the ground of it, and the plaster of that tree stump about the rain forest (referring to areas that are accessible to touch but not specifically designed to be touched by visitors); exhibits about a long time ago; hands-on exhibits; exhibits where its like a puppet play or a movie; its more hi tech; where you do things; probably like buttons and stuff; like touching wood (many of the exhibits have real and simulated wood available to be touched); and the talking tree; you can watch stuff and feel around and stuff; where the whole community can participate in it, like people who want to learn about a certain thing they can come and learn about it and have fun with the different kinds of exhibits they have; you get to touch things and feel things; sounds like maybe things that you're interested in, and you think are thrilling; things like you press the buttons on and you read stuff and it'll ask you questions that you can answer; things that you could enjoy, something that you won't just go to on a field trip and say naw, this is boring, but something that you'll enjoy; for example upstairs there's a board and it had a question on the board and you'd have to lift up and look inside this box to find the answer to see if you were right, so you get to lift open the box and stuff, that's kind of interactive (2); where you get to do things in the exhibit; its like what she said but you get to be a part of it, or

> maybe you get to touch the things and like when you walk into something it'll be like you're a part of it; its where you can touch and feel and see how the thing feels and guess how it feels and then touch it; they're fun; I think something that would be more interactive is like if you have trees out, if someone wants to know what a certain kind of tree bark is like, and it would be great to see some animals around so if you're studying them you could see what they look like, and you can get to know a little more about them than books can tell you; throwing the dirt inside that little thing (the nursery log); the puppet show; the bears and stuff (referring to taxidermied bear and a wood sculpture bear, each set in locations not readily available, and not intended, to be touched); I remember, by the bears, there's these little log things and you get to feel the logs; how about one of those ring puzzles; the buttons; you can touch it physically, not just the text. You can see it mentally. Some of them you can feel and read, and some of them you can just look at and stuff. The physically ones are better because you can play around and touch stuff, because if you just read something you can't do anything, you get bored; its like there's not really any point in doing it, like if you know you're just going to sit and read stuff, its better to look at it and feel it; a museum is kind of mental and physical put together, and the forest is just physically, and the museum is physically and mentally, and a book is just mentally.

One group was asked, How are interactive exhibits different from other exhibits? This prompted further conversations:

Student -- an interactive exhibit is something you can touch, feel, its like 3D to you but something else is like a picture, or something inside the glass that you can't touch but it is 3D, or it could just be a piece of paper with a drawing on it.
Researcher - Okay, what else?
Student -- Like interacting and not interacting, like in interacting you can move around and touch, but in not interacting, like this theater, its not interacting because you just sit here and watch, you don't do anything, you don't move around.
Researcher - Okay, good. Those are good differences. Let's think about the different interactive parts of the exhibits you saw today, and let's just go through them and list them as you think of them.
Students - The nursing log, where you gotta feel what the nursing log is like; the talking tree, you can feel the tree, and you can feel the buttons for what you want it to say;
Researcher -- Does the fact that you push the button to make the things start, is that interactive?
(Students respond with nos and yeses)
Researcher -- Yes it is, because you do something. So you the visitor are doing something to the exhibit, right? I mean you could look at it, but if you push the button, its starts talking.
Students -- Like the videos and stuff they play too; I remember where if you go through a tunnel, there's things that you stomp on and they talk (referring to an exhibit that visitors walk through that has a motion sensor starts a recording of people talking); there was a thing where you went in and a picture went on and told all about some different plants (an automatic-start video production inside a tiny theater).

> Researcher -- That's interactive because you don't have to push the button, but just by walking in there you start it?
> Students -- They have motion sensors; I remember the one where you're seeing some chain, you lift up these little things, and you see... you go to a plant, to a bigger animal, like a deer, and then people (referring to an exhibit about food chains).
> Researcher -- Good, so you lifting the door is interactive. Now, did lifting those doors help you to remember that exhibit?
> Student -- Yes.
> Researcher -- If you were able just to look at it, would you have remembered it as well?
> Student -- Probably not.

One set of third grade subjects gave no responses when asked about interactive exhibits. When they were told that another word for interactive is hands-on, they gave these responses:

> It's where you can touch things and you can pick them up; its like an exhibit where you can kind of pick things up and know what they feel like and kind of touch them, and it was like those tree trunks that showed the Douglas fir and the noble fir and the redwood. Those were nice, those were hands-on exhibits because you could touch them and you could count the rings.

To show the course of their thought, one whole conversation is given here instead of just the responses:

> Researcher --How about the telephones in the bird exhibit. Are those interactive?
> Three students responded yes.
> Researcher -- Okay, so hands-on doesn't mean just putting your hands on things,

it could include listening to things too, right?
Four students stated agreement.
Researcher -- Okay, so you talked about a couple of the interactive exhibits: telephones, talking tree...
Students -- I mentioned the little tree samples; and the fire; that little outside part, where you got to see all the water falls and stuff, that was awesome (referring to a small outdoor patio area).
Researcher -- What makes that area interactive?
Students -- Because you can watch it and you can touch it; I think it makes it an interactive exhibit because you can kind of look at marine life. Like if that was a thousand times bigger it would look like an ocean.
Researcher -- Okay, so you go outside here, and you're kind of a part of it. How about the exhibits where you had to lift up a door. Did you do any of those?
Students -- (three yes responses); we did them up stairs just before it ended; I didn't do so mush of those.
Researcher -- But did you see them?
Student -- Yeah I saw them, they were cool.

This conversation suggests these younger students do not grasp the difference between interactive and other types of exhibits. They agreed with the researcher, but made few assertions of their own that indicated they distinguished interactive exhibits.

Outcome: Overall, students gave a sense they understood that interactive exhibits include some kind of action besides looking and reading. The simplest response, "Where

you get to do things," generalizes and summarizes the majority of responses. Some students, however, had very insightful responses to the question, demonstrating an understanding of the complexity of potential methods in exhibit design.

For these interviews, the definition of interaction converges to include all hands-on, manipulable, interactive and participatory methods, as described by the definitions proposed in this study. It is likely that the subtle differences between the exhibit types would be too complex for students to understand, as was also demonstrated by the first set of interview subjects. This reinforces the suggestion that the public at large considers interactive exhibits to be those "where you can do something."

Question 4: Do you remember some of the interactive exhibits in the museum?

The responses included 21 examples of interactives and two examples of exhibits that were not interactive.

Outcome: Students recognized static visual and multi-media, manipulable and interactive exhibits.

Question 5: What are the benefits of interactive exhibits?

Responses:

> Sometimes it's kind of boring if you're just looking at something, but when you

actually get to get involved with it and touch it and stuff it makes it a little bit more interesting; I think you learn more and it's funner, and you control what you do; you get to touch it and you get to... like the trees that you get to find out how they felt; instead of just seeing a picture, you get to really see the thing (2); and you can do what you want to; it's not like it's controlled, you control it; you don't get in trouble for touching stuff; some of them are like so sensor-detected and everything, its like... (student gives hand gestures that mean she is overwhelmed by an exhibit starting on its own); they're useful, especially if they (visitors) can't read, like they're blind or something; some of the benefits are lifting the things, in learning what the food chain is, its a benefit of learning it, instead of just trying to remember it by just looking at it, it gives you a benefit to be lifting and looking, it helps you remember it; you can learn more, because a picture barely tells you anything, but when you are interactive with the exhibit, it helps you; when you're interacting you can learn more because if you're interactive you remember that you interacted with something, and when you're just sitting there, your mind is somewhere else, you're not, you can't... for me, I can't remember something if I'm just sitting there; sometimes you can break them, that's bad; you could see it up front, so you know more, if you see it in a book you won't know that much; it helps you if you don't know what it feels like, and you can feel it and you'll know what it feels like, and it helps you to see what the real actual colors are; it makes it all exciting, and fun (4); if you don't get to touch something it's not very interesting because you don't know what it feels like; no I just

think they're fun (4); maybe they'll (visitors) learn a lot easier, they can know how it does it (meaning interactives can show how things work); like you can learn about how it was like when your grandparents where here; you get to play with it, and touch it, it's more exciting, more fun; you wouldn't have to do the reading yourself, it will do the reading for you; you get to see it instead of reading about it; like if it's preparing for your job and you can do it better if you know how it feels; this is a tough question; because you get to get your hands on things; it's more fun because you can touch the stuff and it's not really boring, cause you don't want to really read every single thing that they have there, you want to find it out for yourself and then maybe read a little bit about it; if you had a question like what does this tree feel like, you could feel it and know how it feels; if you actually saw that you could actually do it while you're reading about it, it would make it a little bit more fun experience to go to if you read about it and then you get to actually do the thing and see how it works; by benefits, do you mean like good ideas? I think that they are good ideas because, well just like what we've been talking about, if a kid, you know, he's reading all this stuff, he says well I don't understand it, and then there's maybe like a computer game or something that the kid can play around with, he's still learning at the same time, I think that it's better than just reading; some days you gotta have some fun; what I think about interactive exhibits, well at the same time you're having fun with them, you know fiddling around with whatever it is, you're learning something from it, so you can get the best of both worlds if you want. You're having fun with it but you're

also learning something from it; some little kids can't read that well, so it might be a good idea to have like push buttons and have puppets in the exhibit and have more fun on the field trip; it is really fun to press buttons and lift things and just touching things; it's more fun; well I've always had a real imagination for doing things, like making up stories and I just make up a lot of stuff, and I'm willing to express my feelings to what I could do and at the same time I'm having fun; I think they kind of appeal to the younger kids more because so many can't read, and so the smaller kids want something they can touch and feel and play around with; you learn more because you get to feel it and touch, not just think and see; like things that are in glass things where you can just look at it, it's like all you can do is read, but what you really want to do is know what the texture is and you want to know, not just the writings, but you want to feel what they are like; if all we could do is read, I mean people would be just starting to run around and do really crazy things when you're not supposed to, and when you have things that you can touch, it's a lot better for people because they can see what forests are like, and kind of feel things while they are looking and reading. Cause if they have more things to feel while they are reading stuff then it'll be easier for people to learn more; well, sometimes learning can be bad, like if they had crocodiles in the rain forest, people shouldn't allow kids to feel the texture if there is a real crocodile; you gotta treat them with respect, because they're not there for you to ruin; I like the interactive exhibits because it gets kind of boring when you just get to look at stuff. Because all you want to do is just race through it kind of looking at everything

and not reading anything, but the hands-on exhibits really give you enough time to stop and think about it. I think that if there wasn't anything you could touch it would be more boring; if its moving; we just saw the picture, and it moved like really fast. If you see it moving, you see like a frog jump, its more exciting.

Researcher -- How did the interactives affect what you thought about particular exhibits? So if you could compare an exhibit that you are just looking at and reading, compared to something that you get to do, how does that affect the way you feel about it?
Students -- I think it's more interesting and more fun; because you get to do something besides just sitting there and watching; sometimes it's like so boring, you're sitting there just reading stuff (5); you just let it go over your head, you don't really learn anything from it sometimes, with this it sticks in your mind; you can remember something (2); its like 'there'; if it's just a picture, you go (facial expression like trying to figure it out) you don't really know how it looks. It's right there (with interactives) and you know how it feels and everything;
Researcher -- Do you use that kind of learning in school?
Students -- No (3); sometimes but not all the time; you get in deep trouble if you're try touching the instruments -- "keep you hands off that..!"
Researcher -- So at school you're mostly reading and listening? You're not doing as much?
Students -- Yes(2); we get to do science projects, so you get to do something there, so that's fun; except it takes time to do the experiments; also, sometimes when you are just reading and not doing, sometimes you don't think

about it, you think about something else, but when you're doing something with your hands and stuff, it makes you think about it, so you learn more.
Researcher -- So does that apply to interactive exhibits in museums?
Student -- Yes.

Outcome: Students generally recognized some benefit of interactive exhibits compared to static exhibits. Many responses reflected familiarity with classroom methods of practical activities, which most students are familiar with today.

Question Six -- If you could design museum exhibits, what would you put in them?

For the most part, the students gave responses that included interactive opportunities, usually stated as "stuff to do" or as "interactives." Students gave 28 general responses of interactive components. Twenty students listed live animals for their museums, and 21 listed other general topics for their museums (such as Indians, paleontology, stuff from China, trees, etc.). Six students described immersion exhibits, usually using the words "so it feels like you're actually there." Four students mentioned playing games, watching movies, and a combination of both. One student wanted to have computers, and one student chose to include virtual reality exhibits. Four students said they would have a lot of different kinds of things in their

museum. About half of those who included interactive components in their museum gave real examples of their exhibits, rather than saying "stuff to do" or "I would have interactives."

Outcome: It seemed that most of the students were including interactive exhibits in their make believe museums only because this is the subject they had been talking about for fifteen minutes. However, some students gave very elaborate descriptions of the kinds of exhibits they would create and what kind of experience they wanted visitors to have. Students were creative with their answers, and expressed the kinds of things they themselves would like to see in museums.

Data Analysis

It is evident by the interview responses that public visitors to museums do not distinguish between manipulable, device, interactive and participatory and other exhibit types when considering "interactive exhibits" as a whole. From the visitor's point of view, exhibits that allow them "to do something" are interactive. It is also clear that visitors generally agree interactive exhibits have some benefit in adding enjoyment and in contributing to the learning process.

Many respondents recognized that manipulables in exhibits attracted their attention, and knew that they were drawn to some exhibits because there was some manipulation or activity available to them. Half of the adult-child couplets and many of the student respondents indicated that they noticed the interactive components of the exhibits, but gave little indication of having participated with them. Some conceded that they had limited time to visit the exhibits, while others gave no reason for not participating, even while at the same time saying that such exhibits are more interesting, fun or memorable.

Limitations of the Study and Further Research

The various definitions of exhibit types proposed in this paper are not likely to become distinguishable in public usage. Even exhibit professionals may not change their habit of using the terms interchangeably. While the distinction between exhibit types is an effort to point out the relative strengths of each type, there is enough overlap to make separating them difficult. Additionally, creative exhibit design can incorporate several techniques, making it difficult to pinpoint the efficacy of each different component. Additional categories of exhibit techniques may be warranted as creativity in exhibit design grows and takes advantage of new and emerging resources and technologies.

More in-depth questions regarding specific exhibit content, comparing interactive and non-interactive exhibits, may reveal a closer correlation of exhibit type and desired outcome. Incorporating learning theory into interactive exhibit design may result in techniques that better promote learning during the museum experience. Because of the temptation to include interactive and manipulable exhibits for the sake of attracting visitors to our institutions, a better understanding of the effect of each type can help museums achieve the goals of piquing curiosity, holding visitor attention and promoting a learning environment through the use of various exhibit techniques. This way,

museums can increase exhibit effectiveness while at the same time using interactives to draw visitors in.

Conclusion

Museums have a role that incorporates more than teaching, including provoking visitor interest in exhibit subjects, motivating visitors to want to learn more, and simply providing objects (or histories or ideas) from which people may construct their own meaning. Visitors expect to have a positive museum experience that includes enjoyment and an atmosphere conducive to learning. The same methods in exhibit design that add to visitor enjoyment may also be elements that increase the chance for learning to take place. Using manipulable components and touchable objects is an agreeable and increasingly popular exhibit technique. Interactivity is known to increase mindfulness on the part of visitors. Non-interactive manipulables are watered down versions of the interactive technique, providing the visitor with something to do but not following up with the response element that is necessary for true interaction. Therefore, these exhibits, while potentially attractive to the visitor, may not be providing the connection to learning that interactivity is heralded to provide.

Museum visitors have a solid understanding that interactive exhibits provide some kind of participation or activity, and that they are beneficial for improving both learning and enjoyment outcomes. Such outcomes seem to be universally expected, even by visitors who stated they did

not spend time with the interactives during their visit. When asked to describe which elements of the exhibitions were interactives, some subjects gave responses that indicated they did not actually distinguish the interactive exhibits from other exhibits.

While the visitors seem to have an understanding of what interactive exhibits are and what they can provide, they do not necessarily recognize them when they see and participate with them. This phenomenon suggests that interactive exhibits have a value the public recognizes, but that visitors do not necessarily require interactive experiences to meet their own expectations from their visits.

Even though visitors do not always participate with the interactive elements of an exhibition, they recognize their value and come to expect that interactives will be included. While visitors' definitions of interactive exhibits are broad, their perceptions of their experiences with the interactives resulted in positive feelings about their whole visit experience. Therefore, visitor expectations and positive outcomes suggest that museums and other informal learning centers will do well to provide interactive opportunities.

Promoting or claiming use of interactive exhibits when none are really present sets up a question of integrity in

the exhibit process. Are interactives being used to promote interest in the subject, to enhance the chances of visitor learning, or to sell the public on the idea of visiting the museum? All of these are legitimate uses of manipulable, interactive and participatory exhibits. But using manipulative and participatory components in interactive exhibits without connecting the exhibit subject to the activity may cause the exhibits to fail to meet the objectives of increasing visitor knowledge or promoting learning. The potential for losing track of the exhibit's topic and objectives increases as manipulable and hands-on components are added. Except in the most well done exhibits, the gadgetry can detract from the exhibit's subject and from the visitor's ability to make a mindful connection to the topic.

Care should be taken in the development and formative evaluation of exhibits so that the best exhibit technique is matched to the exhibit's subject. The best techniques and methods for an exhibit are those which best illustrate the objects, concepts or ideas being presented. Many museums recently have turned to high-tech and glitzy exhibition styles in an attempt to compete with other recreational and non-formal educational opportunities available for the public to choose from. Sometimes these exhibits are very complex and employ a lot of electronics, lights, gadgetry

and opportunities to play. However, there is a concern that the effort to make exhibits attractive and "fun" may detract from their potential value in piquing visitor interest in the subject rather than in the exhibit technique.

Appendix: Interview Schedule

Interview Schedule -- Data Set One

Why did you come to the museum today?

Have you been to the museum before? If so, what exhibits do you like best?

This project is to get people to think about interactive exhibits. Tell me what you think an interactive exhibit is.

What is the purpose of an interactive exhibit? what do interactive exhibits provide that other exhibits don't provide?

Did you recognize the interactive exhibits in the Special Exhibit Hall? If so, describe them.

What role, if any, do interactive exhibits have on learning about the exhibit content? did our exhibits address these ideas?

Did you participate in the interactives together? If so, how do you think your experience with the interactives together affected your experience?

How did you like the interactive exhibits? Were they better than, the same as, or not as good as the other exhibits? Why?

Did you think they were more fun than the other kinds of exhibits? Did you have a favorite exhibit?

Can you describe the content or subjects of the interactive exhibits? Would you say you learned anything from the exhibits today?

What do you think about the interactive exhibits?

Interview Schedule -- Data Set Two

Do you now why your teacher planned this trip to the museum today? What are you studying in school that is related to this place?

What was your favorite part of the exhibits?

I am especially interested in interactive exhibits. What are interactive exhibits?

Do you remember the interactive part of the exhibits here? List or describe them.

What are the benefits of interactive exhibits?

If you could design the exhibits in a museum, what kind of exhibits would you include?

References

Beer, V. (1987). Great expectations: Do museums know what visitors are doing? Curator, 30(3), 206-215.

Bitgood, S., (1994). What do we know about school field trips?. In What Research Says About Learning in Science Museums, Volume 2, pp. 12-16. Washington, DC.: Association of Science-Technology Centers

Bitgood, S., Paterson, D., & Benefield, A. (1988). Exhibits design and visitor behavior: Empirical relationships. Environment and Behavior, 4(4), 474-491.

Boone, W. & Britt, R. (1994). Museum visitors' attitudes toward exhibits, staffing and amenities. Curator, 37(3), 208-213.

Borun, M. (1989). What research says about learning in science museums: Naive notions and the design of science museum exhibits. ASTC Newsletter, March/April 1989,9-10.

Borun, M. (1983). Enhancing museum education through computers. Roundtable Reports,8(5), 5-7.

Carlson, S. (1995). From hands-on to minds-on: Model for learning in educationally oriented recreation facilities. Legacy, 6(2), 6-12.

Chabay, I. (1987). Flowcommotion and crystal spider: Translating scientific concepts into hands-on learning. In P.G. Heltne and L.A. Marquardt (Eds.), Science Learning in the Informal Setting: Symposium Proceedings (pp. 48-56). Chicago, IL.

Cohen, U. (1987). Learning from children's museums: Implications for design. Children's Environments Quarterly, 4(1), 16-23.

Diamond, J. (1986). The behavior of family groups in science museums. Curator, 29(2),139-154.

Duensing, S. (1987). Science centers and exploratories: A look at active participation. In D. Evered & M. O'Conner (Eds.), Communicating Science to the Public (pp.131-146). New York: John Wiley & Sons.

Eason, L. & Linn, M. (1976). Evaluation of the effectiveness of participatory exhibits. Curator, 19(1), 45-62.

Flagg, B. (1994). Visitors in front of the small screen. In What Research Says About Learning in Science Museums, Volume 2,pp. 21-24. Washington, DC.: Association of Science-Technology Centers.

Hilke, D. D., Hennings, E. C., & Springuel, M. (1988). The impact of interactive computer software on visitors' experience: A case study. ILVS Review 1(1), 34-49.

Koran, J. J., Koran, M. L. & Longino, S. J. (1986). The relationship of age, sex, attention and holding power with two types of science exhibits. Curator, 29(3), 227-235.

Koran, J. J., Longino, S. J., & Shafer, L. D. (1983). A framework for conceptualizing research in natural history museums and science centers. Journal of Research in Science Teaching, 20(4),325-339.

Koran, J. J., Morrison, L., Lehman, J., Koran, M. L., & Gandara, L. (1984). Attention and curiosity in museums. Journal of Research in Science Teaching, 21(4),357-363.

Laetsch, W. M., Diamond, J., Gottfried, J. L., & Rosenfeld, S. (1980). Children and family groups in science centers. Science and Children, March 1980, 17(6)14-17.

Langer, E. J., Blank, A., & Chanowitz, B. (1978). The mindlessness of ostensibly thoughtful action: The role of "placebic" information in interpersonal interaction. Journal of Personality and Social Psychology, 6(6), 635-642.

Miles, R. S. (1987a). Museums and public cultures: A context for communicating science. In P. G. Heltne & L. A. Marquardt (Eds.), Science Learning in the Informal Setting: Symposium Proceedings (pp. 48-56). Chicago, IL.: Chicago Academy of Sciences.

Miles, R. S. (1987b). Museums and the communication of science. In D. Evered & M. O'Conner (Eds.), Communicating Science to the Public (pp. 114-122). New York: John Wiley & Sons.

Moscardo, G. (1988). Toward a cognitive model of visitor responses in interpretive centers. Journal of Environmental Education, 20(1), 29-38.

Moscardo, G. & Pearce, P. L. (1986). Visitor centers and environmental interpretation: An exploration of the relationships among visitor enjoyment, understanding and mindfulness. Journal of Environmental Psychology, 6, 89-108.

Screven, C. G. (1974a). Exhibits and information: Some principles and approaches. Curator, 29(2), 109-137

Screven, C. G. (1974b). Learning and exhibits: Instructional design. Museums News, 52(5), 67-75.

Screven, C. G. (1987). Teaching science to voluntary learners and the role of evaluation. In P. G. Heltne & L. A. Marquardt (Eds.), Science Learning in the Informal Setting: Symposium Proceedings (pp. 230-240). Chicago, IL.: Chicago Academy of Sciences.

Webster's Ninth New Collegiate Dictionary (8th ed.). (1983). Springfield, MA.: Merriam-Webster, Inc.

Williams, L. (1987). Apples, oranges and sometimes unicorns: Appreciating the differences between individual learners. In P. G. Heltne & L. A. Marquardt (Eds.), Science Learning in the Informal Setting: Symposium Proceedings (pp. 316-337). Chicago, IL.: Chicago Academy of Sciences.